EXHIBIT 2

IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF ALABAMA
SOUTHERN DIVISION

HAMAN, INC. d/b/a KNIGHTS INN,	)	
	)	
Plaintiff,	)	
	)	
	)	Civil Action File No.
	)	2:18-CV-01534-KOB
	)	
v.	)	
	)	
CHUBB CUSTOM INSURANCE COMPANY,	)	
	)	
	)	
Defendant.	)	
	)	
	)	

AFFIDAVIT OF KURT D MULDER, P.E.

Personally appeared before the undersigned officer duly authorized to administer oaths, Kurt D Mulder, P.E., who did depose and state as follows:

1.

My name is Kurt D Mulder. I am over the age of eighteen years and competent to give this affidavit, which is based upon my personal knowledge.

2.

This affidavit is given in support of the motion of Chubb Custom Insurance Company ("Chubb") for summary judgment in the above-styled civil action.

3.

I am a professional engineer licensed in Alabama, Arkansas, Florida, Georgia, Louisiana, Michigan, Mississippi and Tennessee.

4.

I hold a Bachelor of Science degree in Civil Engineering from the University of Tennessee, Knoxville, Tennessee.

5.

I have 24 years of experience as an engineer. Since October 2011, I have worked for Engineering Design and Testing Corporation (EDT) as a Consulting Engineer, and as Engineer Manager beginning in 2014. My work has been in the areas of structural engineering for residential, commercial and industrial structures; evaluation of damage to structures from wind, hail, flood, fire and settlement; roof damage; evaluation of construction defects; scope of damage evaluation; analysis of costs to repair and replace damaged property; evaluation of retaining walls and slope stability issues; determining the cause and origin of collapsed structures; building code compliance; evaluation of construction methods and materials; and structural evaluations of framing systems and exterior veneer. A true and correct copy of my curriculum vitae can be found near the end of my expert report, which is attached to this affidavit as an exhibit.

6.

I am qualified by virtue of my education, training and experience to testify as an expert regarding the ability of residential and commercial structures and roof systems to withstand wind, and the cause and extent of damage to structures and roof systems from wind and other weather and temperature elements, construction defects, improper maintenance and repair, and wear, tear, deterioration, biological growth, rot, and other causes. Specifically with regard to this case, I am qualified to testify as an expert regarding the causes of the conditions on the roofs of Haman's hotel buildings and the damage in the interiors of the buildings, and whether these conditions and damages were caused by winds from the tornado in 2014 and rain water leaking through the roofs through openings in the roofs caused by wind.

7.

In 2015, I was retained by Chubb through York Risk Services Group, Inc. to investigate reported storm damage at the Knights Inn in Bessemer, Alabama. The scope of my investigation was to inspect the property, review available information, and determine the cause of the observed damage to the hotel buildings and their roofs and interiors, and evaluate the extent of the damage.

8.

I examined the Knights Inn on September 30, 2015, and prepared a roof evaluation report dated October 7, 2015. A true and correct copy of that report is

attached to this affidavit as an exhibit. I hold all of the opinions stated in this affidavit and in my report to a reasonable degree of engineering certainty.

9.

The roofing of the Knights Inn was reported to have been damaged by a tornado on April 28, 2014. The alleged damage to the roofing was reported to have resulted in water intrusion at multiple locations of the facility's interior.

10.

A detailed description of the Knights Inn's multi-slope metal roofs, flat roofs covered in EPDM (ethylene propylene diene monomer) membrane, and parapet walls can be found at page four of my report, Exhibit 2 to this affidavit. A discussion of my observations of the roofs can be found at pages five through twelve of my report, and a representative selection of my photographs of the roofs is attached to my report.

11.

During my examination of the roofs of the Knights Inn, I observed and photographed multiple locations on the flat portions of the roofs that were holding water over membrane lap seams. I observed the sealant at the lap seams to be cracked and weathered. This condition would allow rainwater to leak through the layers of the roofs, causing deterioration of the roof layers and leaking through the ceilings into the interiors of the buildings.

12.

I observed and photographed numerous separated seams throughout the flat roofs and at portions of the parapet walls. Numerous lap seams had been patched with a white sealant, portions of which were cracked along the lap seams. Portions of the laps seams adjacent to roof penetrations were covered in grey-silver sealant, and portions of those seams were separated. This condition would allow rainwater to leak through the layers of the roof, causing deterioration of the roof layers and allowing rainwater to leak through the ceilings into the interiors of the buildings.

13.

I observed and photographed multiple locations on the flat roofs where core samples had been taken from the roofing membrane. The majority of the sealant on the roof cores was deteriorated and cracking along the edges of the patch, allowing rainwater to leak into the underlying layers of the roof and into the interiors of the buildings.

14.

I observed and photographed multiple EPDM roof patches on the flat roofs. Portions of the patches were bubbled. One patch was torn. One was covered in white sealant, which was loose and could be lifted with finger pressure. This condition also would allow rainwater to leak through the layers of the roofs and into the interiors of the building.

15.

I observed and photographed tears in the EPDM membrane and base flashing adjacent to loose pieces of the parapet wall coping on the flat roofs. This condition would allow rainwater to leak through the roof layers and into the interiors of the building.

16.

On the flat (EPDM) roofs, I also observed portions of the base flashing separated from the roofing in areas where the roof itself was not damaged. Upon closer observation, I saw that the adhesive between the flashing back and the roofing face was missing. This is evidence of age-related deterioration of the roof and improper installation of the roof materials, which would allow rainwater to penetrate the layers of the roof.

17.

I observed that HVAC units at the left and right sides of the flat roofs had been vandalized, which at one location created an opening into the HVAC duct system. This condition would allow rainwater to penetrate into the duct system and into the interior of the building. A portion of the water intrusion at the right side of the ballroom at the facility was the result of water leakage caused by openings in the roof created by vandalism of the HVAC units.

18.

The metal roofing at Building A, in which the office and restrooms were located, was scraped and punctured below the roof access ramp. The HVAC units had missing coils, which likely were stolen by vandals and removed through the access ramp. The damage to the metal roofing on Building A is most likely the result of vandalism activities, and not the result of wind.

19.

On the flat roof portions of Buildings B and C, I did not observe any lifted or curled roofing membrane, or other evidence consistent with wind damage.

20.

On the metal roof portions of Building C, I did not observe any damaged or displaced metal roofing or coping, or other evidence of damage to the roof resulting from wind.

21.

I inspected the sloped roofs, which were constructed of raised-rib metal roof panels. Based upon Google Earth historical and aerial photographs of the facility's roofs, I was able to determine that the metal roofing was installed between June 4, 2006 and September 4, 2010.

22.

Based upon the 2009 International Building Code (IBC), which is used as a reference for proper construction methods and practice, the metal roofs on the buildings of the facility should have been able to withstand 90 mph winds.

23.

The EPDM roofing on the flat roofs pre-dated the metal roofing. According to the staff at the Knights Inn, the EPDM roofing was installed in the 1990s.

24.

The manufacturers of EPDM membranes, including Carlisle SynTec and Firestone Building Products, warranty mechanically attached EPDM roofs for five to twenty-five years. Warranties supplied by roofing manufactures are a good indication of the service life of a roof system.

25.

The EPDM roofing at the Knights Inn was twenty to twenty-five years old (in 2015), which indicated the EPDM roofing system was at the end of its service life.

26.

When an EPDM roofing system reaches or nears the end of its service life, the adhesives and sealants used in the installation of the roofing deteriorate. This results in the separation of lap patches, seam tape, and other materials used to connect and

secure the roofing materials. As the lap seams of the roofing material separate, water intrudes into the interior of the building.

27.

The conditions I observed on the flat EPDM roofs of the Knights Inn indicate that the majority of the water intrusion into the buildings' interiors was the result of the roofing system having reached the end of its service life, and was not the result of damage to the roof caused by wind.

28.

I observed numerous instances of defective materials and defective construction on the metal roofs, including areas on the roofs where the spacing of the fasteners adhering the top and face of the coping was erratic, the fastening was deficient, fasteners penetrated the membrane, fasteners had been pulled out, and portions of the coping did not have fastener holes at the face. These conditions can shorten the life of a roof and allow it to deteriorate faster and to suffer damage as a result of weather conditions including heavy rains and storms that would not damage a properly constructed roof.

29.

I reviewed the installation instructions published by multiple manufacturers of raised-rib metal panels, an example of which is attached to my report. According to the installation instructions, flat pieces of metal trim that overlap the metal panels,

such as the coping, should be fastened every eighteen inches along the face. On the metal roofs of the Knights Inn, portions of the fasteners at the coping facing were spaced twenty-seven inches or greater, and portions of the coping did not have fasteners. These conditions are construction defects and result in the coping having a lowered capacity to resist wind uplift.

30.

I observed that multiple panels on the metal sloped roofs had been installed out of alignment with the adjacent roof panels at the laps; the panel ends at slope transitions and eave ends were not in alignment with the slopes; the panel edges along the valley were cut in an erratic fashion; blocks were missing under the panel ends; pieces of coping were missing; and portions of the roof panels, flashings and copings were installed in an improper manner, which resulted in openings that would allow rainwater to intrude under the roofing and leak through the ceilings into the interiors of the buildings.

31.

The flat roof of Buildings B and C had two layers of roofing. At the top of the parapet wall, the coping was displaced. This would allow the coping to be displaced at below design winds. The EPDM roofing had been installed over the top of the parapet wall in order to prevent water from intruding into the facility. There was missing coping that exposed the open, upper end of the metal roofing panels, which

would allow water to intrude under the metal roofing and onto the top of the old shingle roofing. Portions of the metal roof panels were installed in a manner that created openings in the roof that would allow water to intrude under the roof and into the interiors of the buildings. This is a construction defect.

32.

In my opinion to a reasonable degree of engineering certainty, a portion of the water intrusion at the Knights Inn is the result of the above-described improper installation of the metal roofing.

33.

I observed numerous types of sealants that had been used in attempts to seal the separated lap joints and roof penetrations on the EPDM roofing. The sealants were cracked due to age, indicating the sealant had been applied at an extended period of time in the past. This condition would allow water to intrude at these locations. This is a maintenance issue and not the result of wind.

34.

I observed a punctured EPDM patch on the roof of Building A. There were no scuff marks or scratches next to the patch, which if present would have indicated damage from wind borne debris or foot traffic.

35.

Portions of the EPDM patches on the roof of Building A had bubbles. This condition occurs in roofing when moisture is trapped underneath, vaporizes and expands, stretching the roofing upward in a bubble, causing the roofing and/or the patching to tear and allowing rainwater into the layers of the roof and the interior of the building.

36.

I observed a tear in the EPDM patching on the roof of Building B, which was the result of moisture trapped beneath the surface, stretching and tearing the patch.

37.

I also observed pieces of roof lap tape that were separated and torn at the rear face of the parapet wall, in the base flashing of Building B. In my opinion to a reasonable degree of engineering certainty, this condition was the result of age-related wear and tear.

38.

I observed multiple blocked roof drains and drains without cages.

39.

I accessed the National Weather Service (NWS) Weather Forecast Office website (http://www.srh.noaa.gov) and learned that, on April 28, 2014, a tornado occurred in Bessemer, Alabama. According to the NWS, the tornado ranged between

a level EF-0 to a level EF-2. An EF-0 level tornado has windspeed of between 65 and 85 mph for a 3-second gust.

40.

According to the NWS website, the damage survey report closest to the Knights Inn reported EF-0 level damage occurred 0.1 mile southeast of the facility.

41.

During my inspection of the Knights Inn property, I did not observe any downed trees or large branches, which if present would have indicated that high winds occurred at that location.

42.

The signs advertising the Knights Inn (one large sign and a smaller sign) were attached to their posts and did not show any obvious damage, which if present would have indicated that high winds occurred at that location. See Figure D2 attached to my report.

43.

Google Earth historical and aerial photos taken on September 4, 2010 (Appendix IV to my report) show that a piece of coping was coming off the roof of Building A. This pre-dated the 2014 tornado by approximately four years, and establishes that this damage to the roof pre-existed the tornado.

44.

These photographs of displaced coping on the roofs of the Knights Inn as early as 2010 show that the displacement has been occurring for an extended period of time.

45.

If the Knights Inn had experienced high winds, the metal roofing panels and EPDM roofing would have experienced uplift. Damage to the roofing from uplift would have been indicated by the lifted or curled back roofing. I did not observe this condition at the Knights Inn. The majority of the EPDM roofing was surrounded by a parapet wall, which testing has shown significantly reduces wind uplift on the roofing.

46.

In my opinion to a reasonable degree of engineering certainty, the roofing at the Knights Inn was not damaged by a tornado or high winds. An improper installation of the metal coping has resulted in portions of the coping displacing. Further, the EPDM roofing has reached the end of its service life, which has resulted in deteriorated sealants and adhesives, which has caused separated lap seams throughout the roofing. Portions of the metal roofing panels were installed in an improper manner, which created openings into the roof system. In addition, the roofs

have not been properly maintained and repaired, which has allowed water to seep in to the interiors of the buildings through openings in the roof caused by deterioration.

47.

In summary, the EPDM roofing system failed due to age, the improper installation of the metal roofing panels, and improper maintenance and repair. This has resulted in the water intrusion into the buildings' interiors.

FURTHER THIS AFFIANT SAYETH NOT.

8/13/2020

KURT D MULDER, P.E.

ALABAMA LICENSED No. 24456 PROFESSIONAL ENGINEER KURT D. MULDER

Sworn and subscribed before me
this 13 day of Aug, 2020.

Wanda B. Pratt
Notary Public
My commission expires: 7/31/24

#488108

ENGINEERING DESIGN & TESTING Corp.
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October 7, 2015

ALABAMA LICENSED No. 24458 PROFESSIONAL ENGINEER KURT D. MULDER 10/7/15

REPORT TO: Mr. Stuart A. Mintz
York Risk Services Group, Inc.
1117 Perimeter Center West, Suite W-403
Atlanta, Georgia 30338-5448
Via email: stuart.mintz@yorkrsg.com

FROM: Kurt D. Mulder, P.E.

REFERENCE: Roof Evaluation – Haman, Inc. dba Knights Inn
D.o.I.: April 28, 2014
L.o.I.: Bessemer, Alabama
Chubb Claim Number: WKFC-5689A9
York File Number: YKFA-025719
ED&T File Number: BHM7344-92202

The following is a report concerning an investigation into reported storm damage at Knights Inn in Bessemer, Alabama. The purpose of this investigation has been to inspect the property, review available information, and to determine the cause and evaluate the extent of the observed damage.

The conclusions and opinions stated herein are based on information available to the investigation as of this writing. It is conceivable that additional information may be forthcoming which bears on these conclusions and opinions. Therefore, the right is reserved to review and modify all conclusions and opinions at any future point in time should, in fact, additional information become available.

For ease of reading, this report is divided into sections as follows:

A. Background Information and Work of Investigation

B. Observations

C. Photographic Review

D. Discussion

E. Conclusions

Figures 1-6, A1-A34, B1-B21, C1-C15, and D1 and D2 are included to amplify and clarify the following narrative.

Appendices:

I. Roof Layout SK7344-1 – SK7344-3, Knights Inn, Bessemer, Alabama

II. Aerial Photograph, February 6, 2015, Knights Inn, Bessemer, Alabama

III. Aerial Photograph, June 14, 2006, Knights Inn, Bessemer, Alabama

IV. Aerial Photograph, September 4, 2010, Knights Inn, Bessemer, Alabama

V. Aerial Photograph and Onsite Photograph, Knights Inn, Bessemer, Alabama

VI. Event Summary, Bessemer Tornado – Jefferson County, April 28, 2014, National Weather Service Weather Forecast5 Office website (www.srh.noaa.gov), National Oceanic Atmospheric Administration

VII. Excerpts from Master Rib® Installation Manual, Union Corrugating Company, Rev. 11/07

A. BACKGROUND INFORMATION AND WORK OF INVESTIGATION

Shown in Figure 1, the Knights Inn (facility) is a three building hotel. Each building has a combination of steep slope and low slope roofs. The facility is located at 1121 9th Avenue Southwest in Bessemer, Alabama. Layout drawings of the facility roofs are included in Appendix I and aerial photographs of the facility are included in Appendices II-V to help describe the facility and any observed damage.

Referencing Appendix I, to help in identification of the individual buildings, the buildings have been delineated A-C. For descriptive purposes, left/right and front/rear designations are as viewed facing the facility from the southwest drive.

On September 29, 2015, Engineering Design & Testing Corp. (ED&T) was asked to examine the facility. The facility roofing was reported to have been damaged by a tornado on April 28, 2014. The damage to roofing was reported to have resulted in water intrusion at multiple locations of the facility interior. ED&T conducted an examination of the facility on September 30, 2015. Some of the facility maintenance staff were present during parts of the examination.

According to the maintenance staff, the facility had been reroofed in the early 1990s. Historical aerial photographs of the facility, from Google Earth, were reviewed as part of the examination.

ED&T examined the facility as part of a prior fire loss on March 15, 2014. Photographs of the overall site were taken during that examination and two of the photographs are included with this report as photographs D1 and D2.

B. OBSERVATIONS

1. General

a. The roofing at the facility was comprised of a multi-slope metal roof surrounding a flat roof with parapet walls (Figures 2 and 3). Shown in Figure 3, the parapet walls had sloped sides.

b. Shown in Figure 2, the upper portion of the metal roofs was a steep slope, which transitioned into a lower slope at the bottom portions. The steep slope portions of the roofs comprised the parapet walls surrounding the flat roof portions of the facility. The metal roofing was comprised of raised-rib panels, which were fastened with exposed fasteners (Figure 4). The distance between the raised ribs was measured and determined to be nine inches. A partial metal coping was located at the outside, top edge of the parapet walls (Figure 5).

c. The roofing at the flat roof portions of the facility were comprised of ethylene propylene diene monomer (EPDM) membranes. At numerous locations, straight, raised strips of roofing with circular depressions were observed adjacent to the lap seams of the EPDM membranes (Figure 6).

d. A slope gauge was used to measure the slope of the flat roof portions of the facility, and they were determined to have 0 percent slope.

e. Scuppers were not observed at the three buildings.

2. Building A - Interior

a. Shown in Figure A1, Building A housed the reception area, office, bathrooms, and ballrooms.

b. Multiple ceiling tiles in the reception area were stained from water intrusion (Figure A2). Portions of the ceiling tiles were stained in the bathrooms (Figure A3). Numerous ceiling tiles were stained in the ballrooms (Figure A4). The majority of the stained tiles were in the center of the rooms.

c. Using sliding walls, the one large ballroom could be divided up into multiple smaller ballrooms. The walls were retracted during the examination by ED&T. At the right side of the ballroom, a portion of the ceiling tiles below a heating ventilation and air conditioning (HVAC) penetration were stained from water intrusion and were missing material (Figure A5).

d. The roof structure was observed from the top portion of the roof access ladder (Figure A6). The roof structure observed was comprised of tubular bar joists, with steel decking.

3. Building A Roof - EPDM

a. Multiple locations of the flat roof portion of Building A were observed to hold water (Figure A7). Shown in Figure A7, multiple locations that held water were over lap seams.

b. The sealant observed at the membrane laps seams was cracked and weathered (Figure A8). Numerous separated seams were observed throughout the flat roof and at portions of the parapet walls (Figures A9 and A10).

c. Numerous membrane lap seams were observed to have been patched with a white sealant (Figure A11). Portions of the white sealant were cracked along lap seams (Figure A12).

d. Portions of the lap seams adjacent to roof penetrations were covered in grey/silver sealant (Figure A13). Shown in A13, portions of the lap seams covered in grey/silver sealant were separated.

e. Multiple locations of roof cores, made by unknown parties prior to the investigation by ED&T, were observed in the roofing membrane (Figure A14). Shown in Figure A14, the majority of the sealant used on the roof cores was deteriorated and cracked along the edges of the patch.

f. Multiple EPDM roof patches were observed in the roofing (Figure A15). Shown in Figure A15, portions of the EPDM patches were bubbled. Portions of the patches were cracked at the location of the bubble. A patch located at the right portion of the roof, adjacent to a roof drain, was torn (Figure A16). A patch, located adjacent to the roof access, was covered in white sealant. The patch covered in white sealant, was loose and could be lifted with finger pressure (Figure A17).

g. Tears in the EPDM membrane or base flashing were located adjacent to loose pieces of the parapet wall coping (Figure A18).

h. Lifted or curled back roofing membrane or base flashing were not observed at Building A.

i. Two cores were taken in the EPDM roofing, reference Appendix I for the core locations. Core A and Core B were an approximate 3½ inches deep, and were comprised of an approximate 2 inches of lightweight concrete (LWC), a layer of built-up roofing, an approximate 1 inch of fiberboard, and a layer of roofing underlayment (Figures A19 and A20). Both cores were saturated, and the LWC was the consistency of wet clay.

j. Loose fasteners, trash, pieces of vandalized HVAC equipment, wood boards with protruding nail-type fasteners, and metal roofing scraps were observed lying on the roof.

k. HVAC units, at both the left and right sides of the roof, had been vandalized and the copper coils removed (Figure A21). The vandalizing of the HVAC unit at the right side created an opening into the HVAC duct system (Figure A22).

4. Building A Roof – Raised Rib Metal Roofing

a. A roof access ramp was located at the right side parapet wall of Building A. The ramp allowed access to the metal roof portion of Building A. Portions of the roof panels adjacent and below the ramp were scratched and/or punctured (Figure A23)

b. At the coping, the distance between fasteners adhering the coping, was measured at various locations. The spacing of the fasteners adhering the top and face of the coping at Building A was erratic. The spacing at portions of the coping top and face varied between 9 inches and 36 inches (Figure A24). Portions of the coping at the rear, left, and front sides of Building A were fastened at the face with one or two fasteners, and portions were not fastened at the face altogether (Figure A25).

c. Portions of the metal coping were displaced or missing (Figure A26). Below locations of displaced copings, scraping of the adjacent metal panels or scraping of the adjacent EPDM membranes were observed. At the locations of missing or displaced copings, shingle roofing was observed under the metal roof panels and the EPDM roofing covered the top of the parapet wall (Figure A27). Fasteners from the coping did penetrate the membrane. The top fastener spacing was measured at an exemplar displaced coping, and the spacing measured at the top

portion of the coping ranged from 33 inches to 39 inches. The exemplar coping did not have fastener holes at the face. Portions of the intact copings were dented/wrinkled, and had locations where fasteners had been pulled out (Figure A28).

d. Multiple panels were observed to have been installed out of alignment with adjacent panels, at the laps. The panel fasteners were placed in an erratic fashion (Figure A29). The panel ends at slope transitions and eave ends were not in alignment on the observed slopes (Figure A30). The panel edges along valleys were cut in an erratic fashion (Figure A31). Portions of the roof panels, flashings, copings, etc. were installed in an improper manner, which resulted in openings in the roofing system (Figure A32).

e. At the valleys observed, blocks were not observed under the panel ends (Figure A33).

f. At the left side of Building A, a piece of the coping was missing (Figure A34).

5. Building B Roof – EPDM

a. Building B is located behind Building A (Figure B1). The flat roof portion of Building B was divided into three equal sections by expansion joints (Figure B2).

b. Multiple locations on the flat roof portion of Building B held water (Figure B3). The left section was stained with sediment for an approximate half of its surface (Figure B4). A clogged roof drain without a cage was located under standing water, at the left side of the left section (Figure B5). Two other roof drains were observed that did not have cages (Figure B6).

c. The sealant observed at the lap seams was worn and weathered (Figure B7). Shown in Figure B7, portions of the sealant were cracked along the seams.

d. Numerous lap seams were observed to separated (Figure B8). Multiple roof penetration patches were observed to be separated and curling at the edges (Figure B9). Separated lap seams and penetration patches were observed under standing water (Figure B10).

e. Portions of the lap tape at the left most portion of the rear parapet wall base flashing were separated (Figure B11). The fourth lap tape from the left was separated from the roofing (Figure B12). Shown in Figure B12, the middle portion of the lap was ripped in several locations, along the edge of the left sheet of roofing. The left sheet of roofing was pulling away from the sheet on the right. The left sheet of roofing was flush with the parapet wall surface. The sealant behind the separated tape was worn and cracked (Figure B13).

f. An approximate 12 feet of base flashing was separated from the roofing at the right, rear parapet wall (Figure B14). When lifted, adhesive was not observed at the majority of the flashing back or roofing face (Figure B15). The roofing was not observed to be damaged at the location of the separation.

g. Lifted or curled back roofing membrane or base flashing was not observed at Building B.

h. Referencing Appendix I for locations, two roof cores were taken in the EPDM roofing. Shown in Figure B16, the cores were an approximate 3½ inches deep and consisted of a layer of LWC, built-up roofing, foam insulation board, fiberboard, felt, and EPDM roofing. The roofing core was saturated through all layers.

6. Building B Roof – Raised Rib Metal Roofing

   a. Portions of the metal coping at the parapet wall tops lacked fasteners at the face (Figure B17). Portions of the spacing of the fasteners installed at the top and face were measured and the majority of the fasteners were determined to be spaced 27 inches on center or greater (Figure B18). Portions of the metal coping were fastened in a buckled position (Figure B19).

   b. Numerous roofing panels were observed to be installed misaligned with adjacent panels (Figure B20).

   c. Numerous locations at valleys, panels, and the coping were observed to be installed in a manner to allow water to intrude under the roofing (Figure B21).

   d. Damaged or displaced metal roofing and coping were not observed at Building B.

7. Building C Roof – EPDM

   a. Building C was located to the left of Building A and B (Figure C1). The flat roof portion of Building C1 was divided into three equal sections by expansion joints.

   b. Multiple locations on the flat roof portion of Building C held water (Figure C2). Multiple roof drains were observed to be clogged with debris and/or missing cages (Figure C3).

   c. The sealant observed at the lap seams was worn and weathered (Figure C4). Shown in Figure C4, portions of the sealant were cracked along the seams.

   d. Numerous lap seams were observed to separating (Figure C5). Multiple roof penetration patches were observed to be separated and curling at the edges (Figure

C6). Separated lap seams and penetration patches were observed under standing water.

e. Portions of the lap tape at the base flashing were separated (Figure C7). Shown in Figure C7, the adhesive behind the flashing was worn and weathered.

f. Lifted or curled back roofing membrane or base flashing was not observed at Building C.

g. Numerous locations of the sealant, that had been hand applied, at roof penetrations were cracked (Figure C8).

h. Referencing Appendix I for the location, a roof core was taken in the EPDM roofing. Shown in Figure C9, the core was an approximate 3½ inches deep and consisted of a layer each of LWC, built-up roofing, foam insulation board, fiber cover board, felt, and EPDM roofing. The roofing core was saturated through all layers.

8. Building C Roof – Raised Rib Metal Roofing

a. Portions of the metal coping at the parapet wall tops and faces lacked fasteners (Figure C10). Portions of the coping were displaced (Figure C11). The observed displaced coping did not have face fasteners (Figure C12). The coping had scraped the adjacent EPDM base flashing. Portions of the coping were fastened at the top with a fastener spacing of 5 feet 4 inches.

b. Portions of the coping was wrinkled, buckled and/or ripped (Figure C13).

c. Numerous roofing panels were observed to be installed misaligned with adjacent panels (Figure C14).

d. Portions of the panels were observed to be installed in a manner to allow water to intrude under the roofing (Figure C15).

e. Damaged or displaced metal roofing panels were not observed at Building C.

C. PHOTOGRAPHIC REVIEW

In relation to a prior fire loss, ED&T conducted an onsite at the Knights Inn on May 15, 2014. Two photographs taken at the onsite at the facility are included as Figures D1 and D2.

1. Photograph D1

   a. Photograph D1 shows the left side of Building C, as seen from the entrance.

   b. The metal coping was intact and not displaced at the left side roof of Building C.

2. Photograph D2

   a. Photograph D2 shows a partial view of the left side of Building A.

   b. The metal coping that can be observed at the left side of Building A was intact and not displaced.

D. DISCUSSION

According to the National Weather Service (NWS) Weather Forecast Office website (http://www.srh.noaa.gov), on April 28, 2014, a tornado occurred in Bessemer, Alabama. The event summary for the Bessemer Tornado – Jefferson County is included in Appendix VI. The event summary details the storm damage survey conducted by the NWS.

Tornados are rated using the Enhanced Fujita (EF) Scale. The ratings range from EF0, the lowest, to EF5, the highest. The determination of a tornado rating is made by damage surveys conducted by the NWS. The greater the damage observed at a location, the higher the EF Scale rating. The wind speeds associated with an EF Scale rating are an estimate. Also, tornado damage is localized and decreases in severity the farther away from the tornado epicenter the damage is. According to the NWS summary, the tornado ranged from an EF0 to EF2. The closest damage survey report to the facility was for EF0 level damage. The survey was 0.1 mile southeast of the facility. The estimated wind speed for an EF-0 rating is 65-85 miles per hour (mph) 3-second gust.

The website for Jefferson County, Alabama (www.jeffcoonline.jccal.org), where the facility is located, was reviewed to determine the current adopted building code. The website listed the 2009 International Building Code (IBC) as the adopted code. Though not applicable during the reroofing and construction of the facility, the 2009 IBC is used as a reference for proper construction methods and practices. According to Figure 1609, Basic Wind Speed (3-second gust) in the 2009 IBC, the basic wind speed to be used for design and installation of roofing materials is 90 mph.

According to the 2009 IBC, the roofing materials at the facility should be able to withstand a 90 mph basic wind speed. According to the storm survey conducted by the

NWS, the winds at the facility reached an estimated 65 to 85 mph, which is below the wind speed required by code.

Portions of the coping at the facility were damaged and or displaced. Portions of the coping did not have face fasteners and lacked fasteners at the top. The installation instructions published by multiple manufactures of raised rib metal panels were reviewed as part of this examination. One set of the reviewed installation instructions are included as Appendix VII. In the details of the installation instructions, flat pieces of trim metal that overlap the metal panels, such as the coping, should be fastened every 18 inches along the face. Portions of the fasteners at the coping face were spaced 27 inches or greater. Portions of the coping faces did not have fasteners. These conditions are construction defects and result in the coping having a lowered capacity to resist wind uplift. In Appendix IV, the arrow delineates a piece of coping that is coming off of Building A, on September 4, 2010. This predates the 2014 tornado by an approximate four years. Referencing Figures D1 and D2, two months after the tornado, the metal copings shown missing/displaced in Figures C1 and C11, are intact. This indicates the coping was displaced at a later date. The displacement of the coping at the facility has been occurring for an extended period of time. According to the NWS storm survey, the winds at the facility did not reach the 90 mph design wind required by code. The displacement and damage observed to portions of the coping at the facility were the result of a lowered capacity to resist wind uplift caused by construction defects, and are not the result of the tornado or high winds. Since the coping did have a lowered capacity to resist wind uplift, and the coping was blown off by a below design level wind, the wind is considered a contributing factor to the displacement of portions of the coping.

Lifted or curled back EPDM or metal roof panels were not observed at the facility. The ASCE 7-10, Minimum Design Loads for Buildings and Other Structures (ASCE 7-10), is the standard used for structural engineering design. Per the ASCE 7-10, windward roofs

and decks experience uplift from wind. The metal roofing panels and EPDM roofing would have experienced uplift if high winds had occurred at the facility. Damage to the roofing from uplift would have been indicated by the lifted or curled back roofing. This condition was not observed at the facility and according to the NWS, the winds at the facility did not meet the design/installation values required by code. The roofing at the facility was not damaged by high winds.

According to the facility maintenance staff, the facility was reroofed during the early 1990s. Using Google Earth, historical aerial photographs of the facility were reviewed as part of this examination. Referencing Appendix III, the aerial photograph, dated June 4, 2006, shows that metal roofing had not been installed at the facility. Referencing Appendix IV, the aerial photograph dated September 4, 2010 shows the metal roofing installed. Therefore, the metal roofing at the facility was installed between June 4, 2006 and September 4, 2010.

Referencing Appendix V, the aerial photograph depicts a change in shade of the EPDM roofing on the right, rear EPDM base flashing of Building A. Further, the metal roof had not been installed, which dated the aerial photograph prior to June 4, 2010. A photograph of the same area, taken during the September 30, 2015 examination by ED&T, depicts the same change in shade of the base flashing. Therefore, the EPDM roofing predated the metal roofing, and was the roofing reported to be installed in the 1990s.

The websites for multiple manufacturers of EPDM membranes, including Carlisle SynTec (carlislesyntec.com) and Firestone Building Products (firestonebpco.com), were reviewed. The manufacturers reviewed warranty mechanically attached EPDM roofs for 5 to 25 years. Warranties supplied by roofing manufacturers are a good indicator of the service life of a roofing system. The EPDM roofing at the facility was 20 to 25 years old, which indicated the EPDM roofing system was at the end of its service life.

When an EPDM roofing system reaches or nears the end of its service life, the adhesives and sealants used in the installation of the roofing deteriorate. The sealants and adhesives used at the lap seams of the roofing and base flashing were observed to be cracked and deteriorated. Cracked and deteriorated sealants and adhesives result in the separation of lap seams, patches, seam tape, etc. As the lap seams of the roofing have separated, water has intruded into the interior of the facility. The majority of the water intrusion observed at the facility, under the EPDM portion of the roofing, is the result of the roofing system having reached the end of its service life, and is not the result of a storm.

The EPDM roofing system at the facility being at the end of its service life precludes the repair of the roofing. Therefore, the EPDM roofing at the facility, should be replaced, but not as a result of a storm.

Buildings B and C were observed to have two layers of roofing. All the underlying substrate observed at all the buildings was saturated. The 2009 IBC requires that when the existing roofing has two or more layers of existing roofing installed or when the underlying substrate is saturated, the existing roofing should be removed, if the facility is to be reroofed. Prior to reroofing at the facility, the existing EPDM roofing and the underlying substrates should be removed to the steel decking, but not as a result of a storm.

At the top of the parapet wall, where the coping was displaced, the EPDM roofing was observed to be installed over top the parapet wall. The EPDM being over the parapet wall would prevent water from intruding under the EPDM and into the facility at these locations. The missing coping exposes the open, upper end of the metal roofing panels. Water would be able to intrude under the metal roofing, on top of the old shingle roofing, at these locations. Portions of the metal panel roofing were installed in a manner that created openings in the roofing and would allow water to intrude under the metal roofing, which is a construction defect. The water to intruding under the metal roofing could enter openings in

the shingle roofing or at metal roofing fastener locations. Therefore, a portion of the water intrusion at the facility is the result of the improper installation of the metal roofing, which is a construction defect.

Numerous types of sealants were observed to have been used in attempts to seal the separated lap joints, penetrations, etc. The sealants observed were cracked and would allow water to intrude at these locations. The cracked sealant observed at the facility, used to patch seams and penetrations, is a maintenance issue and not the result of a storm.

A punctured EPDM patch was observed at Building A. Scuff marks or scratches were not observed in the EPDM roofing adjacent to the patch, which would indicate damage from wind borne debris or foot traffic. Portions of the patches observed had bubbles. Bubbles occur in roofing when moisture is trapped underneath, vaporizes and expands, stretching the roofing upward in a bubble. This expansion can overcome the roofing/patches ability to expand and the roofing/patch can tear in response. The tear in the EPDM patch on Building B is the result of moisture trapped underneath the patch, stretching and tearing the patch.

A piece of the roofing lap tape was separated and torn along the edge of the roofing in the base flashing of Building B. A sheet of EPDM roofing can contract after installation. If the contraction is not taken into account, pressure is applied to the lap seam tape. As the tape ages, the tape loses strength through weathering, etc. The sheet of roofing on the left was pulling away from the sheet on the right, and the sheets were flush with the roof surface. This indicated that the sheet on the left was contracting. The separation and tearing of the lap seam tape was the result of the contraction of the roofing sheet pulling on the tape, which was aged and weathered.

The 2009 IBC requires a secondary roof drainage system, such as scuppers, to be installed. Scuppers were not observed. Multiple roof drains were observed at the facility. Interior pipes can be used for a secondary roof drainage system; therefore, the presence of a secondary system was not confirmed. Multiple blocked roof drains were observed. Numerous roof drains without cages were observed. Roof drains pipes without cages can become clogged by water borne debris. The cages keep the debris on the roof where maintenance personnel can remove it. The blocked drains and lack of cages over the drains are hazards and should be rectified as soon as possible.

Adjacent to portions of the deflected coping, portions of the metal roofing or EPDM roofing had scrapes and/or punctures. When the metal coping was displaced, it would have impacted the adjacent roofing, resulting in scrapes and punctures. The coping had an improper installation, which resulted in the coping displacing in a below design level wind. Therefore, the damage to the roofing adjacent to the displaced coping is the result of the improper installation of the coping.

Two HVAC units, at Building A, had been vandalized and were missing their copper coils. At one unit over the right side of the ballroom, the ductwork was open to the outside. During rain events, this condition would allow water to intrude into the duct system and the interior of the ballroom. A portion of the water intrusion at the right side of the ballroom was the result of the vandalism of the HVAC units.

The metal roofing at Building A was scraped and punctured below the roof access ramp. The HVAC units at Building A had the copper coils stolen, which would have to have been removed through the access ramp. The damage to the metal roofing is most like the damage resulting from vandalism activities, and is not the result of a storm.

In summary, the roofing at the facility was not damaged by a tornado or high winds. An improper installation of the metal coping at the facility has resulted in portions of the coping displacing. The EPDM roofing at the facility has reached the end of its service life, which has resulted in deteriorated sealants and adhesives, which has caused separated lap seams throughout the roofing of the facility. Portions of the metal roofing panels were installed in an improper manner, which created openings into the roof system. The EPDM roofing system failing due to age and the improper installation of the metal roofing panels have resulted in the water intrusion at the facility interior.

E. CONCLUSIONS

1. The roofing at the facility was not damaged by a tornado or high winds.

2. An improper installation of the metal coping at the facility has resulted in portions of the coping displacing.

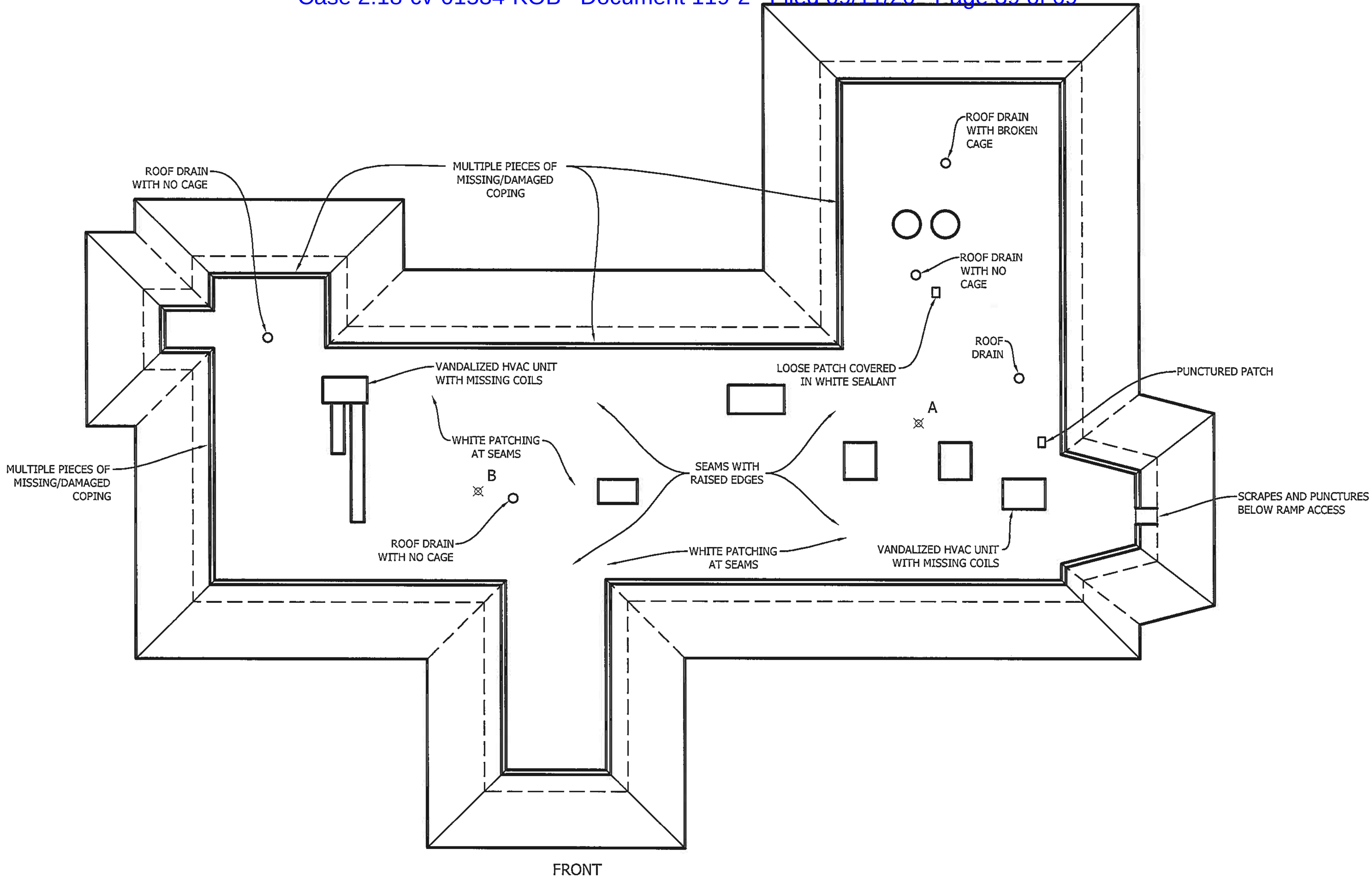
3. The EPDM roofing at the facility has reached the end of its service life, which has resulted in deteriorated sealants and adhesives, which has caused separated lap seams throughout the roofing of the facility.

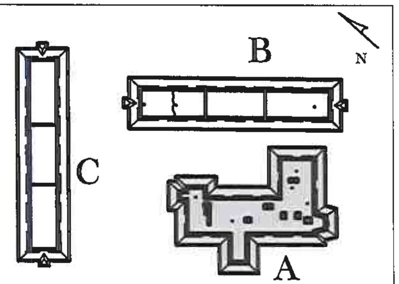
4. Portions of the metal roofing panels were installed in an improper manner, which created openings into the roof system.

5. The EPDM roofing system failing due to age and the improper installation of the metal roofing panels have resulted in the water intrusion at the facility interior.

APPENDIX I

Roof Layout SK7344-1 - SK7344-3,
Knights Inn, Bessemer, Alabama





A LOCATION OF ROOF CORE

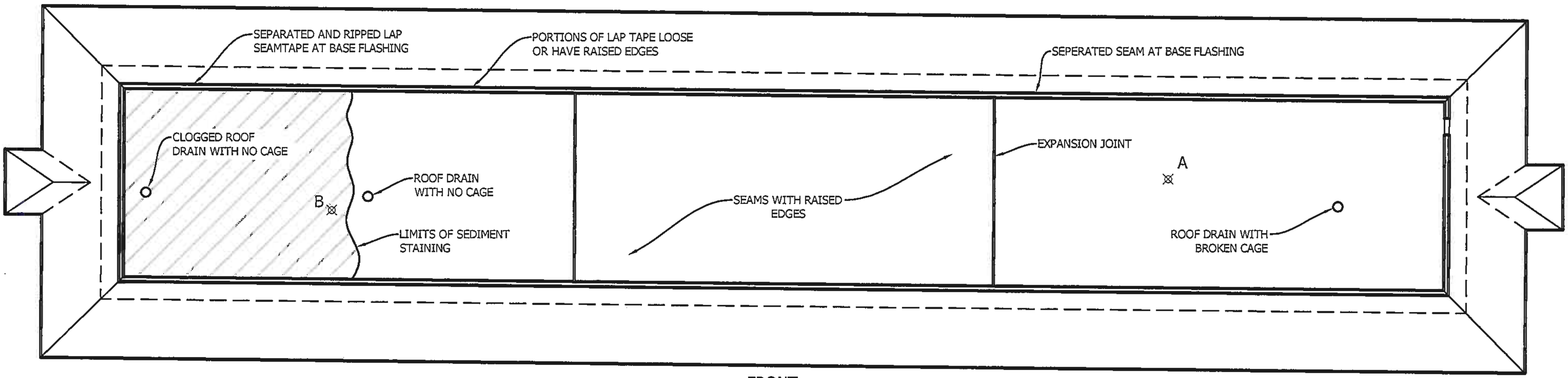
LOCATIONS OF ROOF TOP DAMAGE, APPURTANCES AND EQUIPMENT ARE APPROXIMATE

ENGINEERING DESIGN &TESTING CORP.
ENGINEERS/ CONSULTANTS/ LABORATORIES
POST OFFICE BOX 610406/BIRMINGHAM, AL 35261/TELEPHONE (205)838-1040

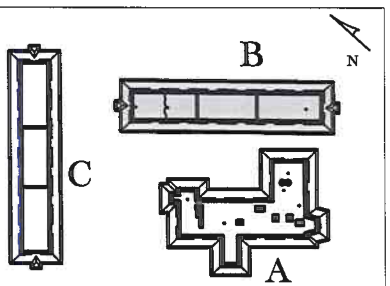
SCALE: N.T.S.	DRAWN BY: J.C.D.	
DATE: 09/30/2015	APPROVED BY: K.D.M.	

ROOF LAYOUT
BUILDING "A"
KNIGHTS INN - BESSEMER, ALABAMA

DRAWING #: ED&T BHM7344	SHEET: SK7344-1



FRONT



A LOCATION OF ROOF CORE

SEDIMENT STAINING

LOCATIONS OF ROOF TOP DAMAGE, APPURTANCES AND EQUIPMENT ARE APPROXIMATE

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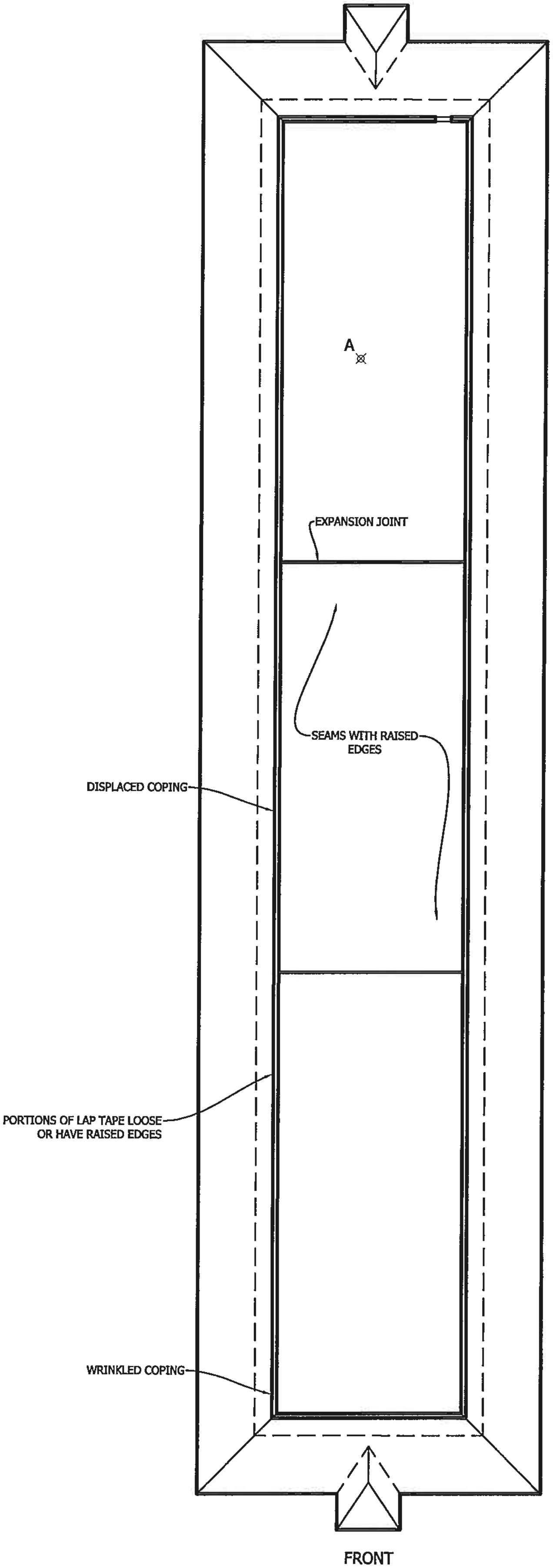
ENGINEERS/ CONSULTANTS/ LABORATORIES
POST OFFICE BOX 610406/BIRMINGHAM, AL 35261/TELEPHONE (205)838-1040

SCALE: N.T.S.	DRAWN BY: J.C.D.	
DATE: 09/30/2015	APPROVED BY: K.D.M.	

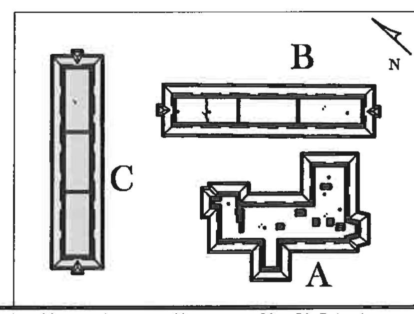
ROOF LAYOUT
BUILDING "B"
KNIGHTS INN - BESSEMER, ALABAMA

DRAWING #: ED&T BHM7344	SHEET: SK7344-2



A LOCATION OF ROOF CORE

LOCATIONS OF ROOF TOP DAMAGE, APPURTANCES AND EQUIPMENT ARE APPROXIMATE



ENGINEERING DESIGN &TESTING CORP.

ENGINEERS/ CONSULTANTS/ LABORATORIES
POST OFFICE BOX 610406/BIRMINGHAM, AL 35261/TELEPHONE (205)838-1040

SCALE: N.T.S.	DRAWN BY: J.C.D.	
DATE: 09/30/2015	APPROVED BY: K.D.M.	

ROOF LAYOUT
BUILDING "C"
KNIGHTS INN - BESSEMER, ALABAMA

DRAWING #: ED&T BHM7344	SHEET: SK7344-3

APPENDIX II

Aerial Photograph, February 6, 2015,
Knights Inn, Bessemer, Alabama


Google earth
Google earth
feet
600
meters
100

APPENDIX III

Aerial Photograph, June 14, 2006,
Knights Inn, Bessemer, Alabama


Google earth
Google earth
feet
600
meters
100

APPENDIX IV

Aerial Photograph, September 4, 2010,
Knights Inn, Bessemer, Alabama


Google earth
Google earth
feet
meters
100
30

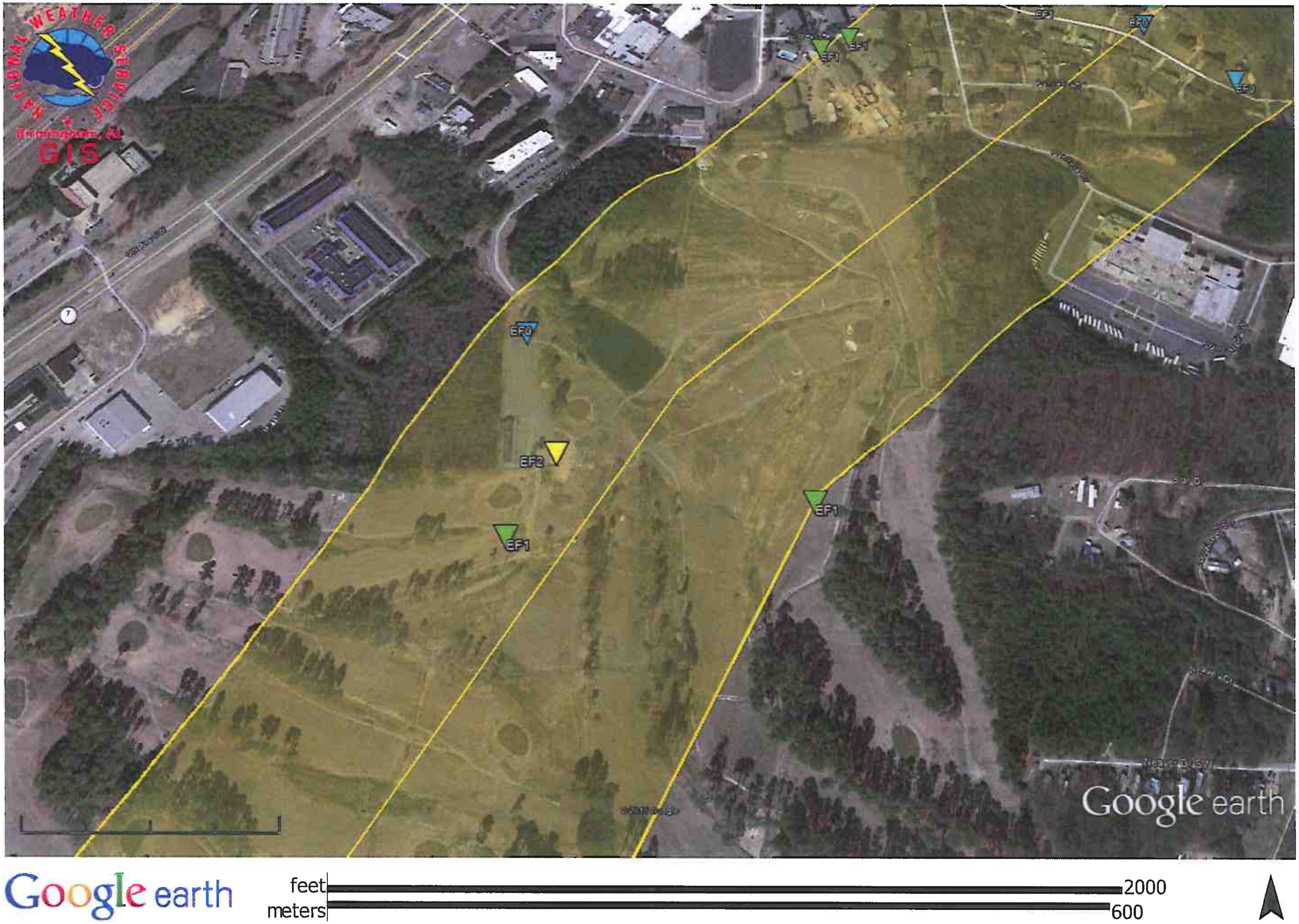
APPENDIX V

Aerial Photograph and Onsite Photograph, Knights Inn, Bessemer, Alabama

bing maps
Print Preview

APPENDIX VI

Event Summary, Bessemer Tornado – Jefferson County, April 28, 2014,
National Weather Service Weather Forecast5 Office website (www.srh.noaa.gov),
National Oceanic Atmospheric Administration



National Weather Service
Birmingham, AL
GIS
EF0
EF1
EF2
EF1
EF1
EF1
EF1
EF0
EF0
Google earth
Google earth
feet
2000
meters
600

National Weather Service Weather Forecast Office

Birmingham, AL

Bessemer Tornado - Jefferson County
2 Miles WSW of Bessemer - 3 Miles NNE of Bessemer
April 28, 2014

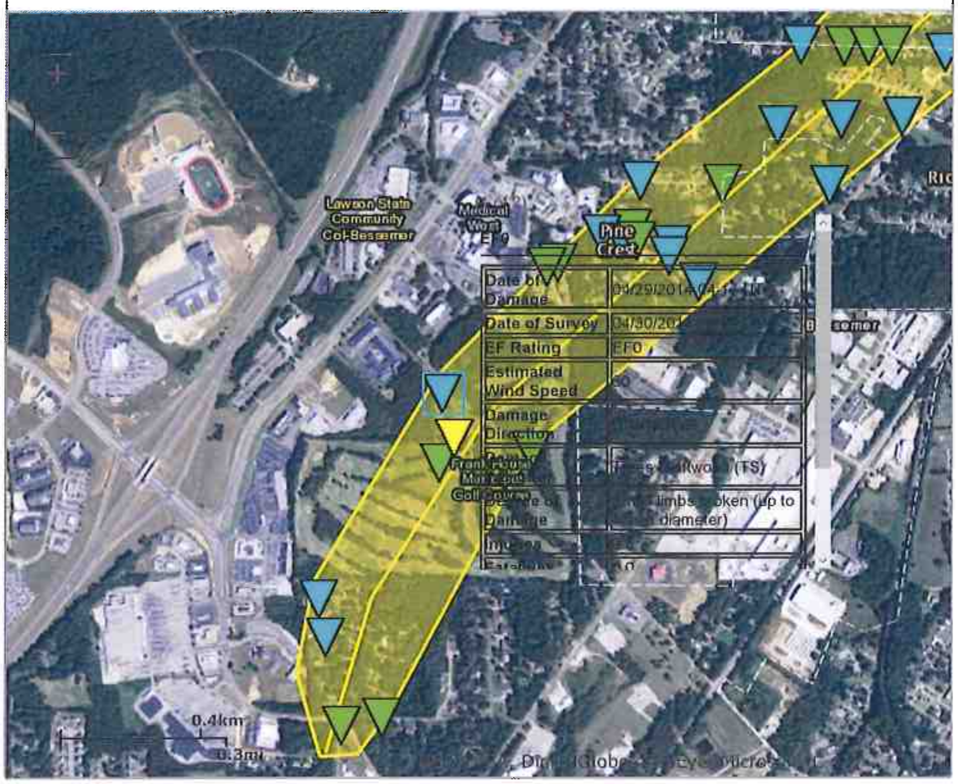
Event Summary

National Weather Service meteorologists surveyed damage in Bessemer and have determined that the damage is consistent with an EF-2 tornado. Maximum winds were estimated to be 120 mph.

The tornado touched down near Academy Drive. It then traveled to the northeast, snapping and uprooting dozens of trees along its path. In addition, dozens of homes had trees down on them just to the northeast of Academy Drive. The tornado intensified as it neared the Frank House Municipal Golf Course where the clubhouse was destroyed. The tornado continued on its northeast path, snapping and uprooting hundreds of trees. Several homes and an apartment complex experienced minor roof damage near Memorial Drive. The tornado continued to the northeast as it paralleled 4th Avenue North. Hundreds of trees were uprooted before it lifted near the intersection of Dartmouth Avenue and 32nd Street South. More details may be added later.

Rating: *(Click for EF Scale)*	**EF-2**
Estimated Maximum Wind:	**120 mph**
Injuries/Fatalities:	**None**
Damage Path Length:	**4.9 miles**
Maximum Path Width:	**600 yards**
Approximate Start Point/Time:	**33.3592/-86.9950 at 1116 pm**
Approximate End Point/Time:	**33.4109/-86.9344 at 1125 pm**

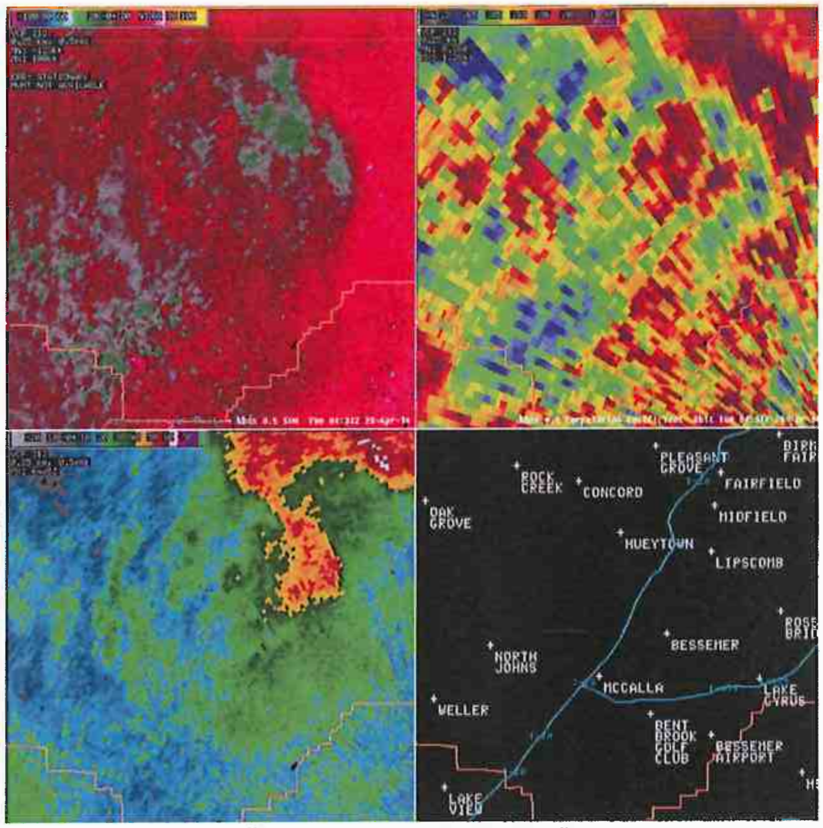
Basemap



View Larger Map

EF5 EF4 EF3 EF2 EF1 EF0 TSTM Other

KML Shapefile



4-Panel Radar Imagery of cyclic supercell.

Tree Damage

Apartment Damage

Tree Damage

Tree & Structure Damage

Roofs Removed


Very Large Root Ball

National Weather Service
Birmingham, AL Weather Forecast Office
465 Weathervane Road
Calera, AL 35040
205-664-3010
Page Author: BMX Webmaster
Web Master's E-mail: sr-bmx.webmaster@noaa.gov
Page last modified: May 12th 2014 5:22 PM

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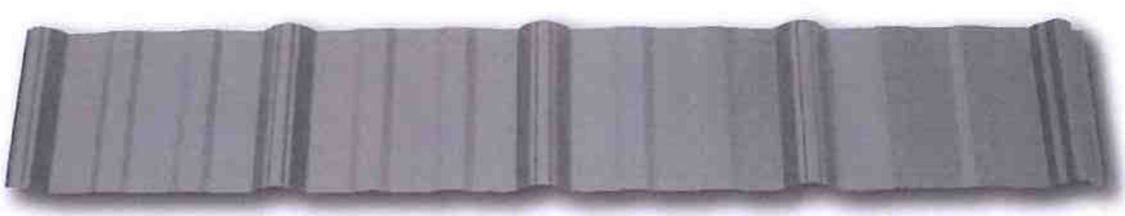
Career Opportunities

APPENDIX VII

Excerpts from Master Rib® Installation Manual,
Union Corrugating Company, Rev. 11/07

MasterRib®
Installation Manual

UNION
CORRUGATING COMPANY



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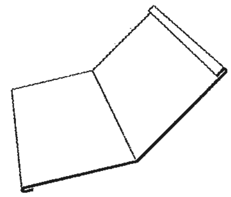
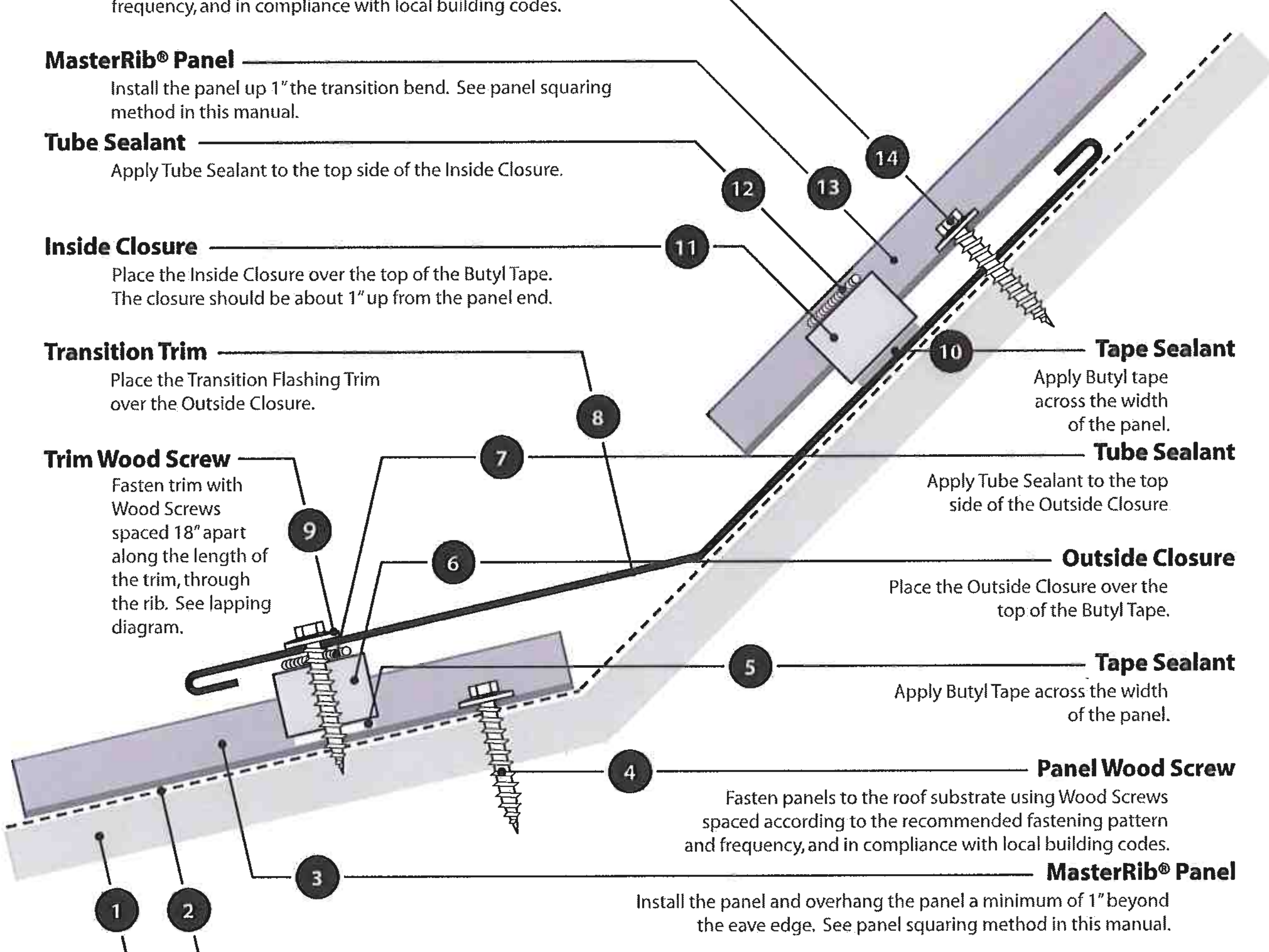
(888) MTL-ROOF

Rev. 11/07

Transition

Numbers indicate suggested trim assembly sequence.





Panel Wood Screw (14)
Fasten panels to the roof substrate using Wood Screws spaced according to the recommended fastening pattern and frequency, and in compliance with local building codes.

MasterRib® Panel (13)
Install the panel up 1" the transition bend. See panel squaring method in this manual.

Tube Sealant (12)
Apply Tube Sealant to the top side of the Inside Closure.

Inside Closure (11)
Place the Inside Closure over the top of the Butyl Tape. The closure should be about 1" up from the panel end.

Tape Sealant (10)
Apply Butyl tape across the width of the panel.

Transition Trim (8)
Place the Transition Flashing Trim over the Outside Closure.

Trim Wood Screw (9)
Fasten trim with Wood Screws spaced 18" apart along the length of the trim, through the rib. See lapping diagram.

Tube Sealant (7)
Apply Tube Sealant to the top side of the Outside Closure

Outside Closure (6)
Place the Outside Closure over the top of the Butyl Tape.

Tape Sealant (5)
Apply Butyl Tape across the width of the panel.

Panel Wood Screw (4)
Fasten panels to the roof substrate using Wood Screws spaced according to the recommended fastening pattern and frequency, and in compliance with local building codes.

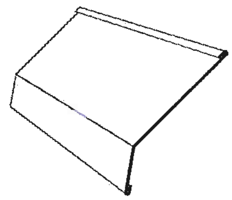
MasterRib® Panel (3)
Install the panel and overhang the panel a minimum of 1" beyond the eave edge. See panel squaring method in this manual.

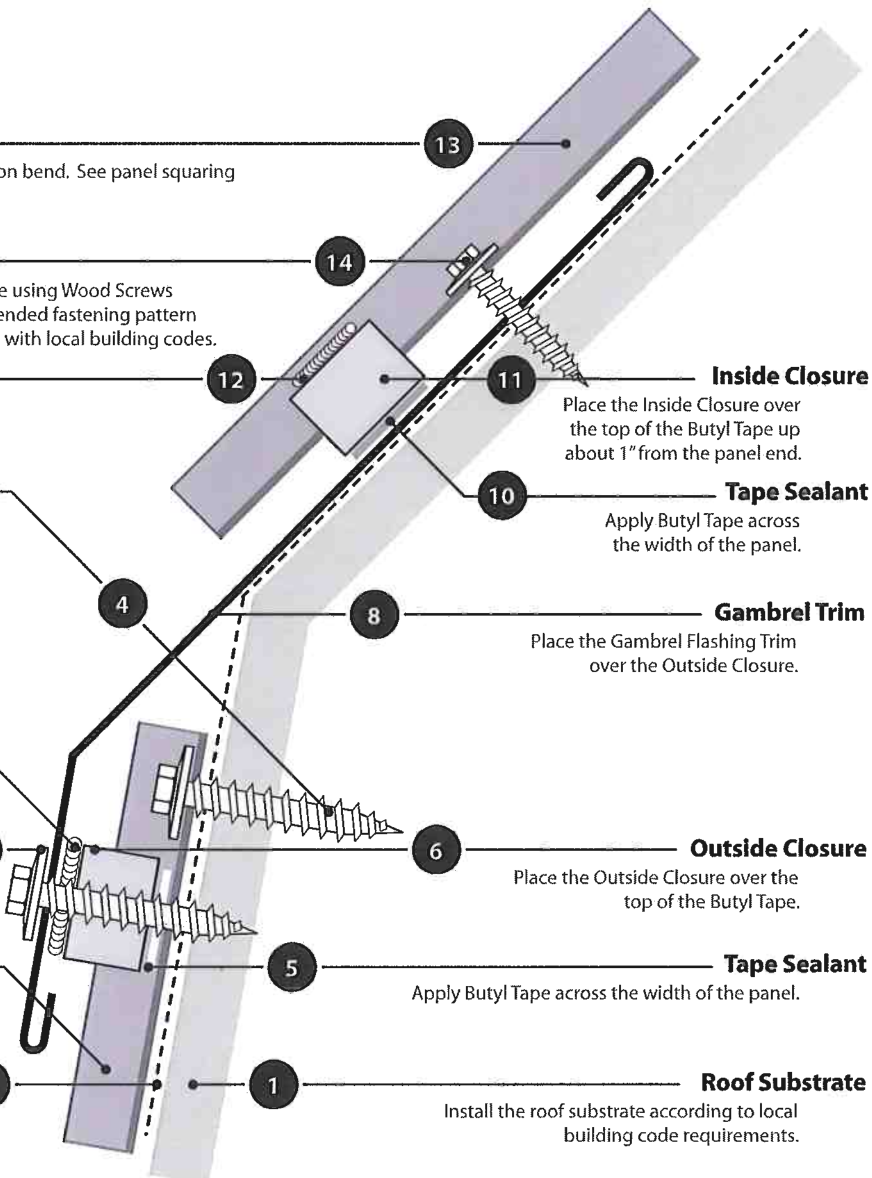
Moisture Barrier (2)
Install moisture barrier according to the manufacture's recommended procedure and in compliance with local building code requirements.

Roof Substrate (1)
Install the roof substrate according to local building code requirements.

Gambrel

Numbers indicate suggested trim assembly sequence.





MasterRib® Panel (13)
Install the panel up 1" the transition bend. See panel squaring method in this manual.

Panel Wood Screw (14)
Fasten panels to the roof substrate using Wood Screws spaced according to the recommended fastening pattern and frequency, and in compliance with local building codes.

Tube Sealant (12)
Apply Tube Sealant to the top side of the Inside Closure.

Inside Closure (11)
Place the Inside Closure over the top of the Butyl Tape up about 1" from the panel end.

Tape Sealant (10)
Apply Butyl Tape across the width of the panel.

Panel Wood Screw (4)
Fasten panels to the roof substrate using Wood Screws spaced according to the recommended fastening pattern and frequency, and in compliance with local building codes.

Gambrel Trim (8)
Place the Gambrel Flashing Trim over the Outside Closure.

Tube Sealant (7)
Apply Tube Sealant to the top side of the Inside Closure.

Trim Wood Screw (9)
Fasten trim with Wood Screws spaced 18" apart along the length of the trim, through the rib.

Outside Closure (6)
Place the Outside Closure over the top of the Butyl Tape.

MasterRib® Panel (3)
Install the panel and overhang the panel a minimum of 1" beyond the eave edge.

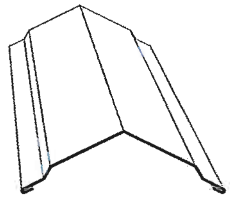
Tape Sealant (5)
Apply Butyl Tape across the width of the panel.

Moisture Barrier (2)
Install moisture barrier according to the manfacture's recommended procedure and in compliance with local building code requirements.

Roof Substrate (1)
Install the roof substrate according to local building code requirements.

Hip

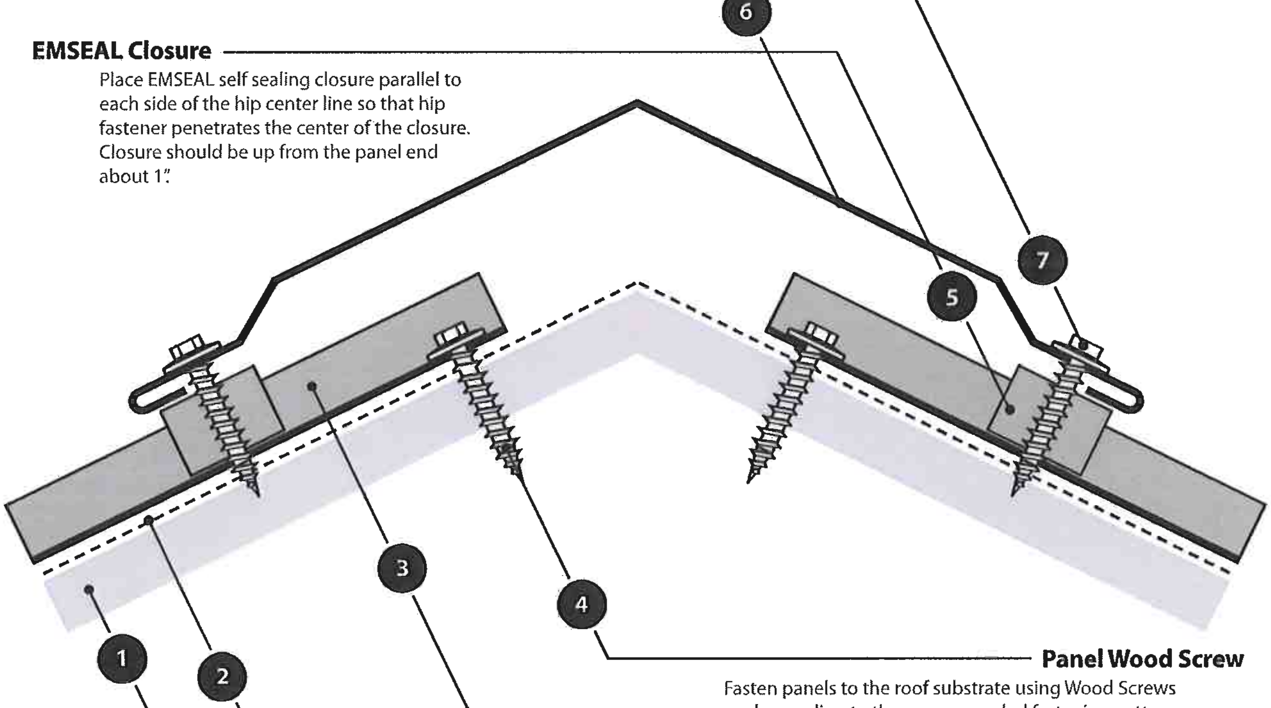
Numbers indicate suggested trim assembly sequence.



Panel Wood Screw
Fasten trim with Wood Screws spaced 18" apart along the length of the trim, through the rib. See lapping diagram fastener pattern in this manual.

Hip Trim
Place the Hip Trim over the EMSEAL Closure

EMSEAL Closure
Place EMSEAL self sealing closure parallel to each side of the hip center line so that hip fastener penetrates the center of the closure. Closure should be up from the panel end about 1".



Panel Wood Screw
Fasten panels to the roof substrate using Wood Screws spaced according to the recommended fastening pattern and frequency, and in compliance with local building codes.

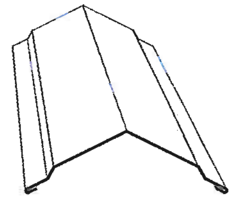
MasterRib® Panel
Install the panel and overhang the panel a minimum of 1" beyond the eave edge. See panel squaring method in this manual.

Moisture Barrier
Install moisture barrier according to the manufacture's recommended procedure and in compliance with local building code requirements.

Roof Substrate
Install the roof substrate according to local building code requirements.

Ridge

Numbers indicate suggested trim assembly sequence.



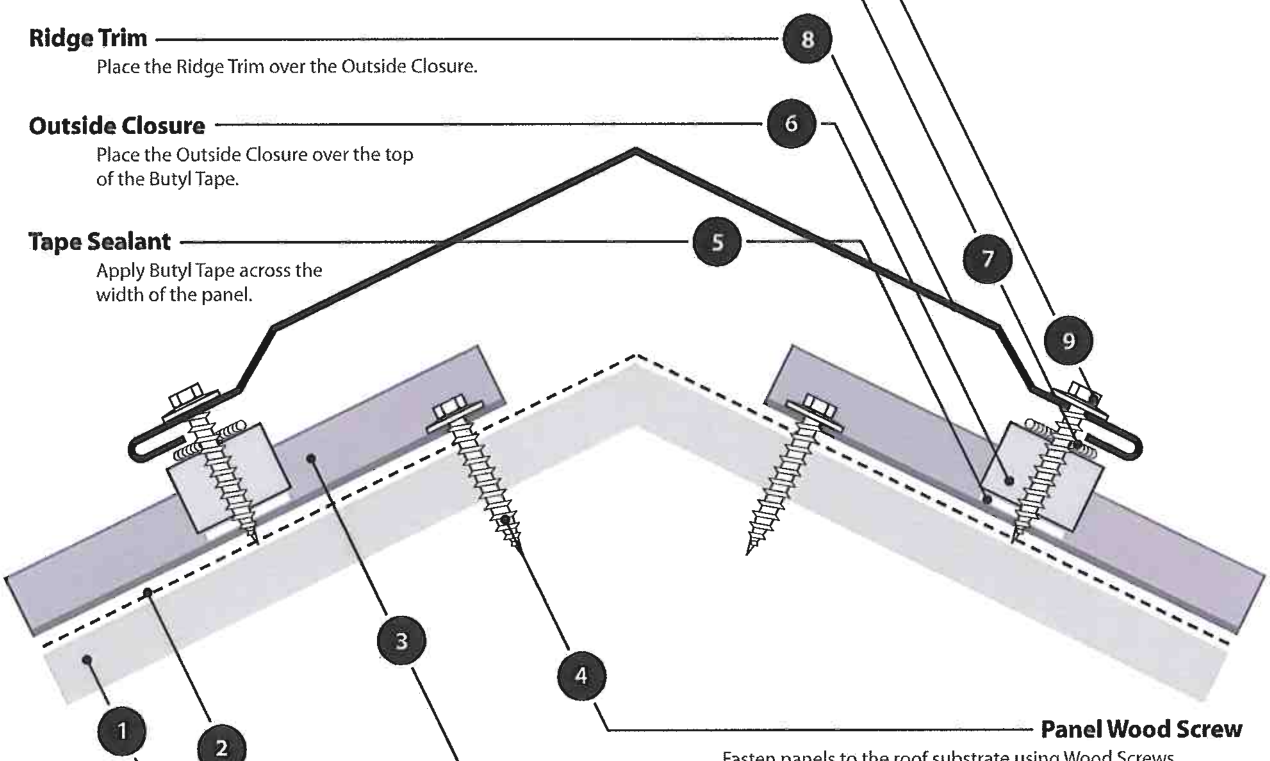
Trim Wood Screw
Fasten trim with Wood Screws spaced 18" apart along the length of the trim, through the rib. See lapping diagram.

Tube Sealant
Apply Tube Sealant to the top side of the Outside Closure.

Ridge Trim
Place the Ridge Trim over the Outside Closure.

Outside Closure
Place the Outside Closure over the top of the Butyl Tape.

Tape Sealant
Apply Butyl Tape across the width of the panel.



Panel Wood Screw
Fasten panels to the roof substrate using Wood Screws spaced according to the recommended fastening pattern and frequencey, and in compliance with local building codes.

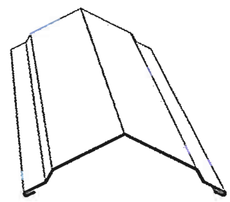
MasterRib® Panel
Install the panel and overhang the panel a minimum of 1" beyond the eave edge. See panel squaring method in this manual.

Moisture Barrier
Install moisture barrier according to the manufacture's recommended procedure and in compliance with local building code requirements.

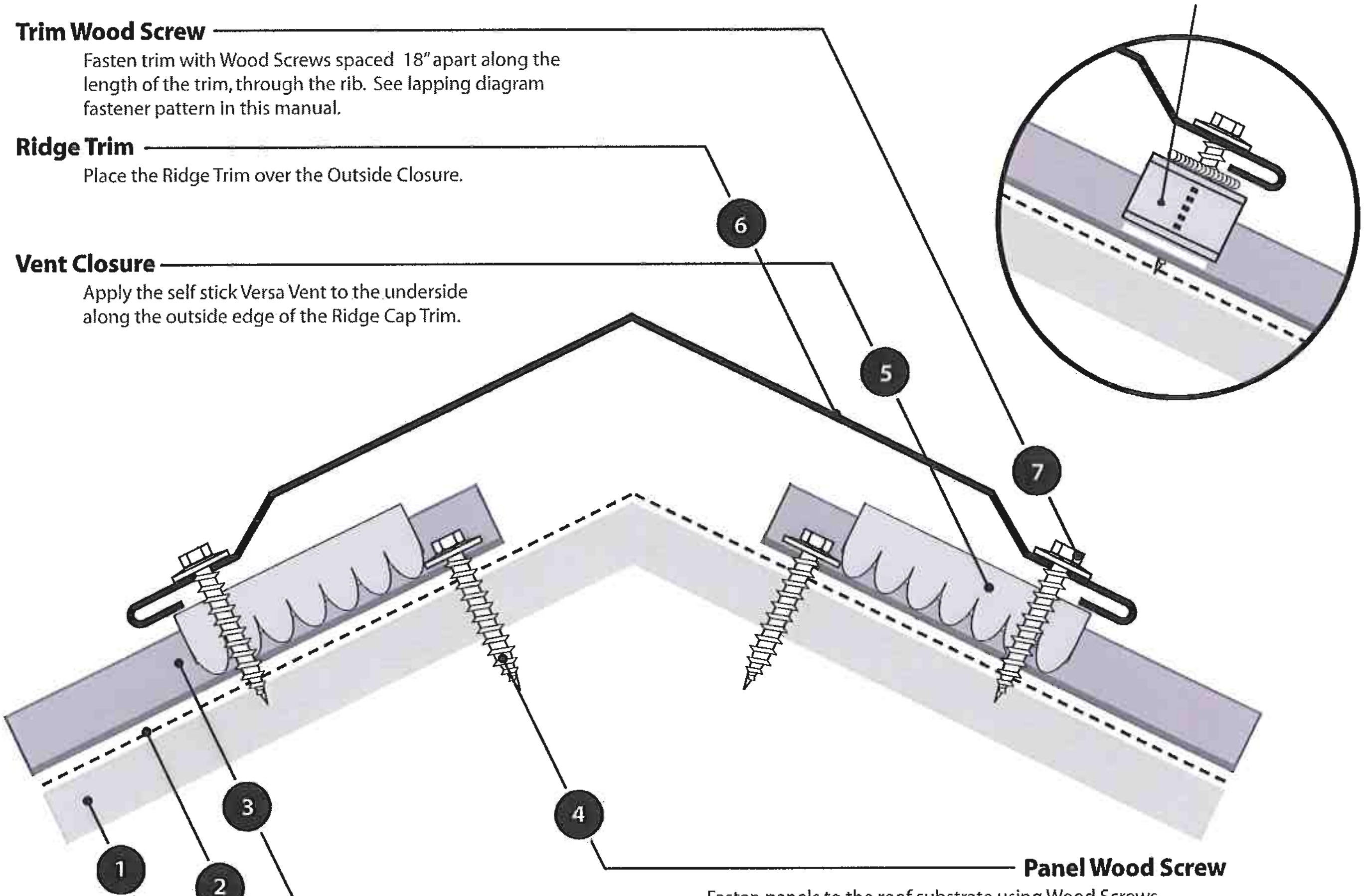
Roof Substrate
Install the roof substrate according to local building code requirements.

Vented Ridge

Numbers indicate suggested trim assembly sequence.



MasterRib Vented Closure Option



Trim Wood Screw
Fasten trim with Wood Screws spaced 18" apart along the length of the trim, through the rib. See lapping diagram fastener pattern in this manual.

Ridge Trim
Place the Ridge Trim over the Outside Closure.

Vent Closure
Apply the self stick Versa Vent to the underside along the outside edge of the Ridge Cap Trim.

Panel Wood Screw
Fasten panels to the roof substrate using Wood Screws spaced according to the recommended fastening pattern and frequency, and in compliance with local building codes.

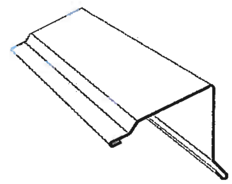
MasterRib® Panel
Install the panel and overhang the panel a minimum of 1" beyond the eave edge. See panel squaring method in this manual.

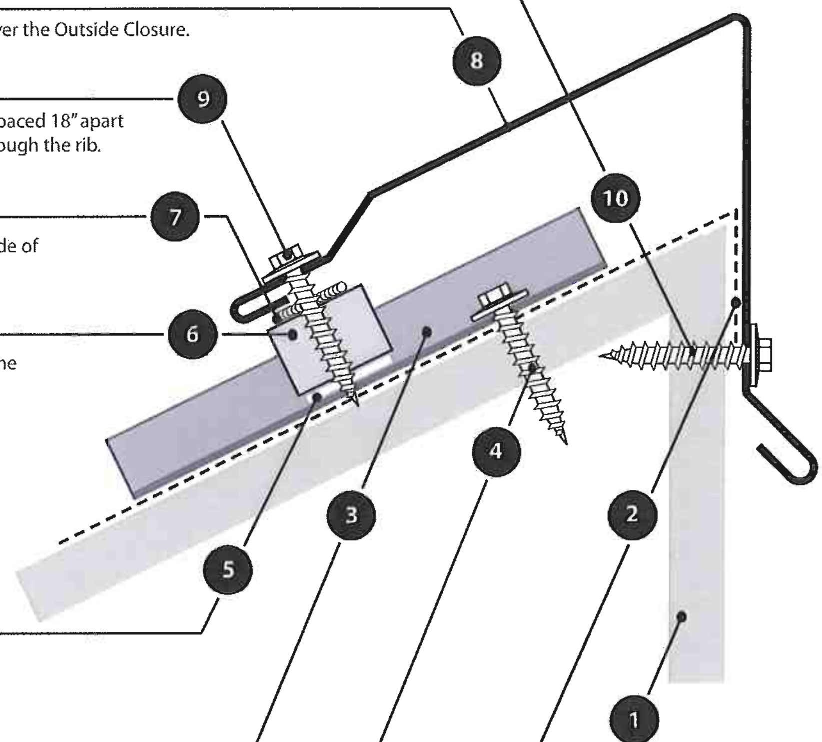
Moisture Barrier
Install moisture barrier according to the manufacture's recommended procedure and in compliance with local building code requirements.

Roof Substrate
Install the roof substrate according to local building code requirements.

High Side Peak

Numbers indicate suggested trim assembly sequence.





Trim Wood Screw
Fasten trim with Wood Screws spaced 2' apart along the length of the trim. See lapping diagram.

High Side Peak Trim
Place the High Side Peak Trim over the Outside Closure.

Trim Wood Screw
Fasten trim with Wood Screws spaced 18" apart along the length of the trim, through the rib. See lapping diagram.

Tube Sealant
Apply Tube Sealant to the top side of the Inside Closure.

Outside Closure
Place the Outside Closure over the tip of the Butyl Tape.

Tape Sealant
Apply Tape Sealant across the width of the panel.

Panel Wood Screw
Fasten panels to the roof substrate using Wood Screws spaced according to the recommended fastening pattern and frequency, and in compliance with local building codes.

MasterRib® Panel
Install the panel and overhang the panel a minimum of 1" beyond the eave edge. See panel squaring method in this manual.

Moisture Barrier
Install moisture barrier according to the manfacture's recommended procedure and in compliance with local building code requirements.

Roof Substrate
Install the roof substrate according to local building code requirements.

ENGINEER: CIVIL/STRUCTURAL

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EDUCATION:

1995 — Bachelor of Science in Civil Engineering
University of Tennessee, Knoxville

EXPERIENCE:

October 2011 to Present — **Engineering Design & Testing Corp.**
Birmingham, Alabama

Consulting Engineer (October 2011-April 2014), Engineering Manager (April 2014-Present). Consulting in the area of structural engineering for residential, commercial, and industrial structures; cause and origin of collapsed structures; evaluation of damage to structures from wind, hail, flood, fire, and settlement; evaluation of retaining walls and slope stability issues; building code compliance; evaluation of construction methods and materials; structural evaluations of framing systems, exterior veneers, roof damage; evaluation of construction defects; scope of damage evaluations; and analysis of costs to repair or replace.

January 2002 to October 2011 — **Geert D. Mulder & Sons Inc.**
Lansing, Michigan

Commercial/Residential Home Builder and Land Developer. Design, engineer and construct subdivisions, single-family housing, multi-family apartment complexes, and commercial facilities. Submit and manage projects through approval processes at municipal boards, planning and engineering departments and all necessary regulators. Production and compilation of submittal packets for government housing projects. Production and submittal of all governmental permitting. Land acquisition and due diligence for future developments. Project schedules, budgets, and safety program. Management project inspection to review schedule parameters, work progression, quality, and safety. Subcontractor selection and management.

October 1999
to December 2001

Gonzalez Strength and Associates, Inc.
Birmingham, Alabama

Engineer. Design and project management of commercial, residential, and industrial site developments. Preparation of full construction documents, including preliminary/final drainage, grading, roadway, and utility layout with details. Engineering design and construction document production for projects. Modeled pre- and post-development, drainage areas and basins to study impact of developments, then mitigated adverse effects with storm water detention systems and best management practices. Designed pump stations and force mains.

May 1998
to September 1999

David Evans and Associates, Inc.
Birmingham, Alabama

Engineer. Design of commercial, residential, and industrial site developments. Preparation of full construction documents, including preliminary/final drainage, grading, roadway and utility layout. Below ground detention design, project review and approvals, coordinate in multiple states and jurisdictions, and with other offices.

July 1997
to April 1998

Fred White Engineering, Inc.
Lansing, Michigan

Engineer. Design and production of construction documents for single and multi-family residential and commercial developments. Municipal and regulating authority modeling approvals. Drainage basins to determine developmental effects and design mitigating systems. Condominium subdivision legal recording documents. Preliminary and final plat production. Survey and boundary drawings from field data and notes. Field surveying including topography and construction staking.

September 1996
January 1997

Asfour & Associates, Inc.
Knoxville, Tennessee

Engineer. Structural component design, including concrete retaining walls.

PROFESSIONAL ORGANIZATIONS:
American Society of Civil Engineers (ASCE)
Structural Engineers Association of Alabama (SEA)
National Association of Subrogation Profession (NASP)

REGISTRATIONS AND CERTIFICATIONS:
Registered Professional Engineer in Alabama (#24456)
Registered Professional Engineer in Arkansas (#15014)
Registered Professional Engineer in Florida (#73757)
Registered Professional Engineer in Georgia (#PE036739)
Registered Professional Engineer in Louisiana (#36898)
Registered Professional Engineer in Michigan (#6201049012)
Registered Professional Engineer in Mississippi (#20610)
Registered Professional Engineer in Tennessee (#115558)
National Council of Examiners for Engineering and Surveying (#21417)
Residential Builder in Michigan (#2101169306)
Real Estate Associate Broker in Michigan (#6502363855)
Certified Residential and Commercial Roof Inspector
Company Certified Rope Assisted Roof Climbing

CONTINUING EDUCATION (partial listing):
ASCE Wind Loads for Buildings and other Structures
Data Technology for Investigations
Snow Load Failures
Construction Defect Investigations
Hydrology – A Look at Stormwater, Drainage and Flooding
Masonry Design: Installation and Workmanship
Safety on the Job
Incorporating Steel Fibers in Your Concrete Slab
Segmental Retaining Wall Design & Construction
Diagnosing Common Concrete Problems
Low Impact Design Using Concrete Products
Steel Connection Design and Failure Analysis
On Thin Ice – Building Failures During Winter
Modern Data Management for Engineering Investigations-Acquisition, Storage and Access

PRESENTATIONS:
Changes in the Wind Provisions in ASCE 7-10 from ASCE 7-05, Technical Presentation; 2013 Annual Engineers Meeting – Engineering Design & Testing Corp.; Columbia, South Carolina; February 8, 2013

Household Failures, Issues and Defects, Presentation to Alabama Chapter of National Association of Subrogation Professionals, Birmingham, Alabama; October 7, 2016

Kurt D. Mulder, P.E. **Evidence Rule 26, Trial & Deposition List**	**August, 2018** **Page 1 of 1**
Deposition, James Aaron Sizemore, as Personal Representative of the Estate of James Edward Sizemore, Deceased, v. Aaron Carr, et al. Circuit Court of Tallapoosa County, Alabama at Alexander City	November 6, 2014
Deposition, Nick Jones and Pamela Jones v. Spring Aire, L.L.C. and Pamela Weems Circuit Court of Jefferson County, Alabama Birmingham Division CV-2015-903369	March, 2, 2017
Trial, Weems, Pamela v. Spring Aire, LLC Circuit Court of Jefferson County, Alabama CV-2015-902273	August 23, 2017
Deposition, Everette Joe Brown v Trustmark National Bank Circuit Court of Escambia County, Alabama CV-2015-900216	September 18, 2017

Fee Schedule for Kurt D. Mulder, P.E.

Time: $225.00 Hourly
(includes: review of material; depositions, expert witness testimony)

Expenses – at cost

Mileage: $.58 per mile

As is our company's practice, we will bill you only for work done and expenses incurred.

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we're looking at potential failures of that column. But typically we're not looking for whether that steel rebar is expanding or not.
Q Well, when it rust, could it expand? I mean, does it -- because of the rust, does it somehow get bigger, put pressure on the grout which would put pressure on the CMU block?
A So, those three items that you listed have different coefficients of thermal expansion which would be the rebar, the grout and the masonry block and these are numbers that are very, very, very small. Something to the nature of ten times -- one number times ten to the negative six. That is five zeros before the actual value.
So, yes, they could potentially expand very, very, very little.
Q What about over a period of 60 to 70 years, could the expansion -- would time also have anything to do with the amount of expansion that could occur?
A Perhaps.
Q And if that expansion did occur over 50, 60, 70 years, is it sufficient -- could it be sufficient to cause the cracks that we're looking at here?
A No.
Q So it is your opinion that there is no

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possibility that expansion of the rebar due to rust is in any way responsible for these cracks?
A That's correct.
Q And it's your opinion that the CMU blocks around the garage door, including on the lintel, or is it just on the sides, has to be torn out and replaced?
A At least the ones on the side.
Q The vertical?
A The vertical columns would at least have to be /TORP out. At that point we would probably go ahead after take a look at the lintel and also replaced the lintel also.
Q But you wouldn't be able to know that until after?
A Right, after the basically during the /TKEPBLG /HREUGS for the structural repair work that I do, we provide basic details and then once the demolition begins then we go out there and reassess it and then we assess the qualities of all the structural members in that area. In this case it would be at least the blocks on both sides of this garage.
Q When did this crack form that I'm looking at in photograph 36?
A I do not know which day it formed.
Q Well, you were out there in December of 2018,

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right?
A I believe so, yes.
Q You have no idea when that crack formed before you arrived on the scene?
A That is correct. Sometime before I arrived is what I can say.
Q Can you tell me how long before you arrived it formed?
A No.
Q Could it have been a matter of days?
A I mean, that's certainly a possibility.
Q Could it have been a matter of weeks?
A That's also a possibility.
Q Could it have been a matter of months?
A Yeah, also a possibility.
Q Could it have been a matter of years?
A Yeah, those are all possibilities. I would -- yeah.
Q Are the replacement of the CMU blocks along the vertical side of the sides of the garage door on the west elevation the only areas where you feel that the CMU block needs to be removed and replaced?
A Yes.
Q Is there any reason to sandblast the entire west elevation in order to make a repair?

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A The sandblasting helps to remove some of the parging that's partially detached. It would help to clean out the inside of the cracks, so it would be a first step towards a repair solution.
Q Does the entire west elevation need to be sandblasted?
A I found quite a few cracks in that area and for -- and it's about maybe 60 or 70 feet long. I would probably recommend that the whole thing be sandblasted to ensure that we address all the cracks in that area and to ensure that any loose pieces of parging or whatnot are removed from the building during that process.
Q What about the north elevation?
A Yes, I would recommend just going ahead and doing a full sandblast, and then that would clear out the cracks, it would clear out any sort of paint or anything inside the cracks and it would provide a fresh start in order to start the repair process for repairing the cracks.
Q Will the sandblasting remove all the parging?
A I don't think so. It would probably just remove an initial layer of the parging.
Q And does then the parging then need to be reapplied or would you sandblast and then just paint